Note on Strömberg's Method of Determining Mean Absolute Magnitudes

In this method[1] the true mean absolute magnitude of a group of stars is obtained by comparing the geometrical mean of their peculiar radial velocities with that of a certain function of their proper motions. All stars are included except those for which the peculiar velocity (or other quantity, as the case may be) is very small or zero. It is the purpose of this note to show how this limitation may be removed.

We have to take the arithmetical mean of the logarithms of the velocities. For those above some finite limit (say, for example, 1 km) no difficulty arises; but the logarithms of the few small values are negative and may be very large or even infinite.

Suppose that there were a great many such quantities uniformly distributed thru the interval from 0 to 1 with respect to the quantity itself, not its logarithm. Tho the logarithm of the limiting value 0 is infinite, it is easy to show that the mean of all the logarithms will be finite and fairly small. At the limit, when sums go over into integrals, this mean will be

$$\frac{\int_0^1 \log x \, dx}{\int_0^1 dx} = \frac{\left[x \log x - x\right]_0^1}{1} = -1$$

the logarithms being "natural logarithms."

Thus, *if a series of numbers are distributed uniformly and densely between 0 and 1, their geometric mean is $1/e$, where e is the "base of logarithms."* Similarly the geometric mean of numbers uniformly distributed between 0 and n is n/e.

From this it follows that the cases previously excluded in Strömberg's method can be included by assuming that all the velocities, etc., below some convenient limit ought to be uniformly distributed between this limit and zero, and substituting for the logarithm of each of them the logarithm of the geometric mean for such a distribution, that is, the value

$$\log \text{limit} - \log e,$$

or, if the logarithms are ordinary ones to the base 10,

$$\log \text{limit} - 0.4343.$$

How high to take the limit of application of this process is a matter of judgment. It is probably well to make it high enough to include

[1] *Contributions from the Mount Wilson Observatory*, No. 144; *Astrophysical Journal*, **47**, 12, 1918

a fairly considerable number of observed values, provided that it is not extended so far as to include a region within which the distribution of the observed quantity departs seriously from uniformity.

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NOTE ON THE USE OF THE GEOMETRICAL MEAN PARALLAX

In the preceding note Professor Russell has pointed out a method of including small values of radial velocities and proper-motion components in the computation of geometrical mean parallaxes according to the formulae in *Mount Wilson Contribution* No. 144. A similar method of dealing with these small quantities was actually employed in the publication cited, namely, that of placing the radial velocities or proper-motion components in a number of classes, and for each class substituting the arithmetical mean for the individual values before taking the logarithms. Thus all radial velocities smaller than 2 km., and all proper-motion components smaller than 0".010 were put equal to 1 km. and 0".005, respectively The difference between this method and that of Russell is slight, but the latter is probably to be preferred.

In this connection attention may be called to the fact that, if the proper motions are all very small, the geometrical-mean parallaxes are uncertain on account of the errors in the measurements. In the first place these errors are enhanced in the logarithms; and in the second place they are systematically affected by the circumstance that the arithmetical mean, disregarding the sign, of a series of very small *measured* quantities is systematically larger than the corresponding mean, corrected for observational errors, by a quantity that is of the order of magnitude of the average error in the measurements.

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THE MAGNETIC POLARITY OF THE SUN-SPOT GROUP OF MARCH 21, 1920

The spot group which crossed the central meridian of the Sun on March 21, 1920, was the largest since the great group of August, 1917. Because of its connection with the aurora and magnetic storm of March 22, an account of its magnetic field may be of interest.